PROTECTIVE GLAZING STUDY

for

National Preservation Center

Nachitoches, Louisiana

by

Inspired Partnerships, Inc.

Chicago, Illinois

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ABSTRACT

Inspired Partnerships, a Chicago not-for-profit, received a National Preservation Center (Center) grant in October 1995 to investigate the virtues and liabilities of various protective glazing (PG) installations over stained glass which was completed June 30, 1996. This 157-page study addresses the general usage, history, aesthetics, energy effect, and conservation issues regarding protective glazing over stained glass in churches and synagogues.

Although numerous studies on protective glazing over stained glass have been completed in Europe since the 1970s, much of this research is only germane to medieval glass located in European cathedrals. Such windows often receive museum-quality conservation and window care sponsored by various Governments, tourism dollars, and other revenues. These installations often warrant the cost of "isothermal" settings which place the precious stained glass under totally controlled environmental conditions; circumstances that are rarely applicable to the vast majority of American stained glass windows.

Inspired Partnerships' protective glazing project represents the first U.S. study to address issues pertinent to typical American installations and post-industrial stained glass. The project entailed several stages of research, field work, and testing that provided case studies and data which were incorporated throughout the study.

An international literature search was undertaken which uncovered 168 resources included in the bibliography. A stained glass studio survey of 200 studios and individuals yielded forty responses from seventeen states, Canada, England and Yugoslavia. One hundred randomly selected PG installations were investigated nationwide in four different climatic regions including Charleston-Savannah, Chicago, Phoenix-Albuquerque, and Portland-Seattle to document typical installations and their impact on aesthetics and maintenance.

In addition, dataloggers were installed in the air space of two south-facing windows (vented and unvented) to collect a year's worth of temperature and humidity data comparing the air spaces with both indoor and outdoor environmental conditions. Moreover, an energy model of a Chicago church was developed and "tweaked" by Enermodal Engineering, Inc. of Denver, Colorado to determine the true energy value of double glazing over stained glass; the resulting computer model was evaluated in four other climates as well. Finally, ten PG installations in Chicago were altered in various fashion, either removed, vented or replaced. These case studies revealed further information regarding the impact of PG on light and sound transmission. They also served to illustrate proper protective glazing solutions given various architectural, social, and economic parameters.

This work not only documented the use of PG in the United States since the late 19th century, it established a foundation of hard data for further American studies to build upon. Despite the professional encouragement to vent PG installations in the American stained glass industry for more than fifteen years, only 4% of the 100 windows surveyed nationwide were intentionally vented, another 19% had self-vented from the breakdown of sealants.

All plastics, (acrylics or polycarbonates) will eventually haze, yellow and scratch and should not be used. Nearly all property owners who employed plastic PG materials (about 65%) were displeased with their appearance today. Removal of yellowed, hazy, and dirty PG increased the daylight through one case study window over 100%! When necessary, only plate, tempered, or laminated glass should be used depending upon the installation parameters.

Energy savings are often promoted by manufacturers and installers of protective glazing. However, the study revealed that the payback for PG used on intermittently occupied buildings (e.g. churches and synagogues) ranged from a minimum of 36 years in Toronto, Canada to over 1,500 years in Phoenix, Arizona! This represents a lower return on investment than an equal savings account. The Enermodal report concludes *"The results show that the energy savings from protective glazing for an intermittently occupied church do not warrant the expense of installation."*

The study confirmed that solar gain on east, south and west windows in the U.S. with protective glazing causes a "greenhouse" effect-- increasing heat and condensation in the air space. Stained glass surface temperatures of windows covered by unvented PG typically ranged 10°F to 20°F higher than uncovered or vented windows; a high of 118°F was recorded on the interior surface of one recently restored window. Ironically, recently restored stained glass with new sealants and putty trap the most heat and cause the highest expansion-contraction. This exacerbates deterioration at the very beginning of the window's service life. The highest internal air space temperature recorded by the dataloggers in Chicago reached 165°F. Unfortunately, the exact computation of lead creep is currently beyond the state of the art. However, tests and equations developed for the study indicate that if a stained glass panel is going to deform, it will deform twice as fast at 120°F than at 70°F.

Field surveys further demonstrated the difficulty of recording lead came and glass deterioration due to humidity and condensation. The stained glass matrix is normally quite durable and can often withstand years of adverse conditions before problems become readily apparent. However, ultraviolet light, heat and particularly moisture rapidly deteriorate the paint, putty and sealants protecting the exterior window sash and frame in an unvented airspace. This leads to serious deterioration of the wood, steel, and masonry that provide the structural support for the window.

Perhaps the greatest deterioration caused by PG is related to the human nature of "out-of-sight, out-of-mind." The field survey clearly showed that protective glazing breeds complacency. Over 80% of the windows surveyed required moderate to serious maintenance that would necessitate the removal of the PG itself. Given this expensive proposition, most property committees ignore exterior maintenance for years which dramatically increases restoration costs. Such neglect can eventually lead to partial or total window collapse during windstorms. In many cases, stained glass windows are better maintained and preserved without protective glazing.

The project goal is to raise the quality of standards for protective glazing installations over stained glass. Inspired Partnerships and the Center intend to publish these study results in various preservation, stained glass, scientific and religious journals, and present the findings to both professionals and consumers at national conferences.

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